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ABSTRACT

This study developed a statistical model to identify college students most prone to dropping out, testing the model to predict the retention status of black residential and white commuter students at an historically black institution with an open admissions policy. The model used 25 pre- and early-matriculation variables, including gender, age, ethnicity, citizenship, state and country of residency, enrollment status, high school class size, high school rank, high school grade point average, scores on the American College Testing(ACT) Service examination, grades in developmental courses, number of developmental courses required, first-semester credit hours attempted and completed, first-semester grade point average, and cumulative grade point average. Multivariate models (both direct and forward stepwise) using logistic regression analysis were developing using data from a sample of 1,949 first-time degree-seeking freshmen who entered the institution from 1990 through 1995. Compared to withdrawing students, returning students were significantly more likely to report better academic habits and goals, to have higher ACT scores and higher high school grades and class rank, to be a white commuter student, and to attend college full-time. Overall, the forward stepwise model was judged better for predicting retention status than the direct model. Results have implications for early identification of high-risk students. (Contains 49 references.)(DB)

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Student Retention in an Historically Black Institution

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Running Head: Persistence at Historically Black Institution

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Persistence of Commuter and Residential Students at a Historically Black Institution

It was conservatively estimated that in the academic year 1993 over 800,000 entering freshmen withdrew from post-secondary education institutions in the United States prior to their second year (American College Testing, 1993; Snyder & Hoffman, 1995). Measured in terms of departure, "41 of every 100 entrants will depart the higher educational system without earning a college degree. Most (three-quarters) of them will leave school in the first two years of college, the greatest proportion occurring in the first year of college" (Tinto, 1987, p. 21).

While retention issues associated with a changing student population are relevant to most colleges and universities, they are of particular concern to institutions that have high percentages of nontraditional students. Because nontraditional students tend to have higher withdrawal rates than do traditional-aged students (Astin, 197[illegible], recent shifts in the composition of the higher education student population may cause concern for colleges and universities today. Among all public four-year institutions, the freshman-to-sophomore attrition was highest at those institutions with open admissions policies and at historically black colleges and universities (American College Testing Program, 1993;). Consequently, these colleges must look for ways to identify students who might be at risk and to assist them, regardless of their level of preparation, in reaching their college goals. To shed light on this issue, we attempted to develop a statistical model to identify those prone to dropping out based only on pre- and early-matriculation variables. Our goal was to predict the retention status of black residential and white commuter students at an historically black institution with an open admissions policy and to examine the nature of any differences between black residential and white commuter students.

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Review of literature

The most widely discussed and researched retention model is one developed by Tinto (1975). In this model, student retention is a function of a complex series of interactions between a student and the institutional environment. Background characteristics (e.g., family background, individual attributes, and pre-college schooling) interact with each other and, in turn, influence both commitment to the institution and to graduation. Such commitment is increased to the extent that the student/institutional match fosters both academic and social integration. Elements of the Tinto model have been demonstrated to be particularly appropriate for explaining student retention and attrition for the typical student at a residential institution (Munro, 1981; Pascarella & Terenzini, 1979).

However, this model is not as effective in explaining retention for commuter and other non-traditional students (Grosset, 1989; Harrison, 1986;). Bean and Metzner (1985) found that "the most important (retention) variables are likely to differ for subgroups such as older students, part-time students, ethnic minorities, women, or academically under prepared students at different types of institutions ..." (p. 529). In fact, Terenzini and Pascarella (1978) suggested that "the academic and social correlates of attrition may be different for different kinds of students" (p. 364). Even Tinto (1982) indicated concerns about the applicability of his model to non-traditional students and institutions, as he stated that "it (the model) fails to highlight the important differences in education careers that mark the experiences of students of different gender, race, and social status backgrounds" (p. 689). Such problems with his and other models led Grosset (1989) to conclude that "since there is not a generalized, all-purpose attrition model for all institutions, colleges need to develop their own models" (p. 15).

Another problem exists when colleges try to use existing persistence models to help them select students for admission. While variables related to social and academic integration can be

strongly correlated with success in college, they are primarily based on behaviors or outcomes that occur well after matriculation. Consequently they are not helpful if the colleges' attempts are to select students that will succeed and to address pre- or early-matriculation factors in their retention efforts. This problem seriously handicaps institutions that aggressively seek students who will match their institutional environment. To address this issue, it might be possible to develop general frameworks and practices using pre- and early- matriculation variables that guide model development.

Pre- and Early-matriculation Variables Influencing Persistence.

Bean (1980), Pascarella (1983) and others have discussed conceptual schemes that have merit for categorizing the various retention factors include those schemes. The framework developed by Bean and Metzner (1985) appears to be particularly well suited for developing a conceptual model of nontraditional undergraduate student attrition. Not only does it emphasize commuter students but it also offers categories of defining and background (including academic background factors), environmental, academic outcome, and psychological factors that relate to those variables typically associated with retention at commuter institutions.

Any number of pre- and early-matriculation variables could be useful in predicting future retention. For example, withdrawing students are more likely than returning students to have lower college aptitude test scores, lower high school grade point averages, and rank lower academically in their high school class (American College Testing Program, 1993; Civian & Schley, 1996;). The higher the perceived quality of high school and the better the study habits, the more likely the student is to remain in college (Lenning, Beal, & Sauer, 1980; Morgareidge, 1988.)

In addition, students who attend college full-time are more likely to remain in college than those who attend part-time (Feldman, 1993; Voorhees, 1984). The number of

developmental courses required and the grades attained in these courses could be correlated with retention in that status (i.e., students who are required to take of participate in developmental courses are typically less academically prepared) (Ryland, 1992). Commitment to persist, the goal of graduation, as well as degree aspirations in general are correlated with retention for commuter students (Edwards & Waters, 1982; Lenning, 1982).

While some studies show that younger students are more likely to withdraw from college, others show that older students are more likely to do so, and still other studies found no relationship between age and retention. Similar conflicting results were also found for gender and marital status (Bean & Metzner,1985; Frone & Rice, 1987; Huston-Hoburg & Strange, 1986;).

The number of hours and location of employment appear to be influential in determining the impact of employment on retention status. That is, if students work less than twenty-five hours per week and/or on campus, such employment can actually increase the likelihood that they will remain in school (Astin, 1975; Lenning, Beal, & Sauer, 1980). The type and amount of financial aid received are also related to retention and there appears to be a greater relationship between aid and retention early in the educational career of a student (Beal & Noel, 1980; Lenning, Beal, & Sauer, 1980). Further, the amount and type of financial aid received might be a better indicator of retention status for high-risk students than for other students (Moline, 1987; Somers, 1995;).

The Role of Residential and Racial Status on Persistence.

Commuter institutions often provide fewer opportunities for social involvement and integration than residential institutions (Allen, 1986), meaning that the commuter students tend to be less integrated socially and academically into the campus than are their residential peers

(Chapman & Pascarella, 1983; Tinto, 1987). For these reasons, the external environment appears to exert a greater influence on dropout decisions of commuter students than residential students (Tinto, 1987; Webb, 1988;). Commuter students are more likely to be employed and to work a greater number of hours per week than residential students which can influence their enrollment decisions (Walleri, 1981).

A variety of studies (Kallingal, 1971; Pfeiffer & Sedlacek, 1971; Tinto, 1982) indicated that commonly identified retention variables had different effects on minority students than on white students. Nettles, Thoeny, and Gosman (1986) also note that black students typically have "significantly lower levels of pre-college preparation than white students, are less academically integrated, have less satisfaction with their universities, experience more interfering problems, and have less well-developed study habits" than do their white peers (p. 309). For black students entering predominantly white universities, success in college was dependent mainly on their motivation and goals (Sedlacek and Brooks, 1976). Further, black students might have a greater tendency than white students to view college as a means to employment (Minatoya & Sedlacek, 1983; Smitherman & Carr, 1981).

Levin and Levin (1991) reported that (a) academic preparedness --high school grade point average and class rank, (b) enrollment in college preparatory courses, (c) adaptability, and (d) commitment to educational goals are student characteristics that have the largest impact on at-risk minority student persistence. However, regarding goals, Richardson and Bender (1987) reported that African-American students generally hold less lofty educational occupational goals than do other students.

Nettles, Thoeny, and Gosman (1986) found that Scholastic Aptitude (SAT) scores, student satisfaction, peer relationships, and interfering problems had different predictive validity for the retention status of black and white students. SAT scores, in particular, were not as strong

predictors for black students as for white students. Sedlacek and Brooks (1976) found that several key non-cognitive predictors, including self-concept, realistic self-appraisal, and preference for long-range goals, were particularly good predictors of retention for minority students. In contrast, Smitherman and Carr (1981) found that black students placed greater emphasis on the short-term goal of quick entry into the job market than did their white counterparts. However, Eimers & Pike (1997) found that the academic performance of minority students did not help to predict their intentions to stay or leave the institution.

In summary, it appears there are a number of pre- and early- matriculation variables that might be related to retention and be helpful to institutions in their selection/admissions processes. Further, many of these variables might have different influences on the retention rates of minority students and on the institutions' ability to identify students at-risk of dropping out. A model that could identify preconditions for attrition could be used in concert with traditional models and might prove helpful in understanding the complex decisions to stay in school and offer possible solutions to lower attrition rates for freshman students.

Methodology

Our research addressed two main questions: (1) to what extent will a linear combination of pre- and early-matriculation variables correctly classify the retention status of those first-time entering degree-seeking freshmen who are black residential students or white commuter students? and (2) What is the nature of any differences between the groups of black residential students and white commuter students? To predict retention status, we used multivariate logistic regression analyses, with attrition status as the dependent or outcome variable and a variety of pre- and early-matriculation variables as the independent or predictor variables. A cross validation of each model was done with split sample procedures. To compare the characteristics of both white commuter and black residential students we used chi-square and t-statistics tests.

Subjects:

The sample was derived from an historically black and open admissions university located in a mid-western state. The sample consisted of 1949 first-time entering, degree seeking freshmen who entered the University from 1990 through 1995 and who completed the "Entering Student Survey" and provided a student identification number. The sample comprised 63 percent of the total cohort population.

To determine if the sample was representative of the cohort population, a series of comparisons were made on the key variables of ACT test score, ethnicity, gender, high-school grade point average, first-semester college grade point average, and number of developmental courses required. Chi-square statistics and t-tests were used to compared the sample with the population group and we found there were no significant differences between the sample and the cohort group on any of the reference variables.

Data Collection and Instrumentation

The classification system suggested by Bean and Metzner (1985) was used to identify categories of variables that would be used to evaluate the attrition rates. Since social integration and academic outcome factors are typically related to academic performance at the end of the first academic year or to interpersonal activities as part of the campus experience, they were not considered in these models. The grouping factors of retention status, ethnicity, and residential status were considered part of the model development.

Multivariate models were then developed using logistic regression analysis. While both direct (all variables entered) and forward stepwise models were explored, the forward stepwise models proved to be the better models offering greater stability or parsimony. The models were based on goodness-of-fit tests to determine the overall fit of the model to the observed

frequencies and to examine how various iterations of the models improved their ability to predict the dependent variable.

The pre- and early-matriculation variables we used focused on demographic information, such as gender, age, ethnicity, citizenship, state and country of residency, enrollment status at time of entry, and whether or not the student is a first-time entering student. We also collected information on prior academic experiences including high school class size, high school rank, high school GPA, and composite and sub-scores on the American College Testing Service (ACT) examination. College academic information included course grades for the developmental courses of mathematics, English, and reading, number of developmental courses required, first-semester credit hours attempted, first-semester credit hours completed, first-semester grade point average, and cumulative grade point average. See Table 1 for a complete list of the variables and variable names.

Methodological Issues and Assumptions

The ultimate goal was to develop a model where the combination of variables would most accurately classify the cases of the verification sample. Such a model would be stable and generalizable to other samples. To identify a model that would place students in one of two groups -- those likely to persist versus those that would not, we split the subjects into two roughly equal groups. One group of cases was used to develop the model and a second group was used to verify the model.

Although logistic regression analysis is free of assumptions about the distributions underlying the independent variables, there were several issues that we addressed: (a) outliers -- we examined each variable to determine if any category had 90 percent or more of total cases to assess its contribution to the predictive capability of the analysis. For continuous variables, the

Mahalanobis distance was calculated for each case and cases with standardized distances greater than 3.0 units were eliminated. Regarding discrete multivariate outliers, we eliminated two variables, EMPLCAMP and MARRIED, that had categories with over 90 percent of the total cases. Regarding continuous multivariate outliers, we checked to make sure there were no cases with a standard Mahalanobis distance beyond three units and eliminated four cases with residuals greater than two standard deviations from the actual value; (b) ratio of cases to variables -- for the purposes of the study, any predictor variables with parameter estimates or standard errors that were more than five times the group average were eliminated. As no values fell outside of the predefined range of plus or minus five times the respective mean, the ratio of cases to variables was deemed to be adequate; (c) adequacy of expected frequencies -- goodness-of-fit tests were used to evaluate expected cell frequencies for all pairs of discrete variables, including the outcome variable. We eliminated any discrete variables if the expected frequencies were greater than one or if more than twenty percent were less than five; (d) multicollinearity -- to reduce the likelihood of multicollinearity in the analysis, the parameter estimates, results of convergence, and correlation coefficients of all bivariate pairs of predictor variables were examined using Pearson's product moment correlations, Spearman correlation coefficients, Cramer's V statistics, and Eta(h) coefficients. Any variable with related parameters that had standard errors five times as large as the mean was eliminated; (e) internal consistency of derived variables--several of the variables utilized in this study were derived as the sum of a larger number of responses on the "Entering Student Survey." To determine the reliability of these derived variables, a Coefficient Alpha was calculated for each of them. The computed values for Coefficient Alpha were high, ranging from .78 to .93. Based upon the outcomes of the tests for issues and assumptions, the predictor variables available used in the analyses of our research questions are found in Table 1.

In addition, to determine differences between white commuter students and black residential students, frequency counts and chi-square statistics were developed for the categorical variables, using retention status as the row variable. Further, using retention status as the grouping variable, sample means and t-tests for independent samples were generated for the continuous variables. Correlation coefficients between the predictor variables and the criterion variable were also computed to identify any difference between groups.

Results

Tables 2 and 3 summarize the percentages and chi-square values for the variables related to the returning and withdrawing students for each of the nominal and ordinal variables as well as the means and t-values for the interval variables. Significant differences were found between the returning and withdrawing students for the following variables: DEGREELU, GRANT, HOMWK, NUMDS, RESETH2, SCH, SEX, and STATUSEN. In addition, significant mean differences were found between the returning and withdrawing students for the following variables: ACTCOMP, ACTMATH, ADEQPRIR, HS_GPA2, and RANK2. See Table 2 for details.

Based upon these results, when compared to withdrawing students, returning students were significantly: (a) more likely to be pursuing a bachelor's degree at the university studied; (b) more likely to study a greater number of hours; (c) more likely to be receiving financial aid in the form of a grant or scholarship, but less likely as a loan; (d) more likely to require none or only one developmental courses and less likely to require three courses; (e) more likely to be a white commuter; and (f) more likely to be attending college full-time. In addition, returning students have significantly: (a) higher mean composite ACT scores; (b) higher ACT math subscores; (c) higher mean high school GPA's; and (d) higher high school class ranks than do

withdrawing students. Returning students also reported a significantly higher mean score of adequacy of their high school education.

The variables that correlated highest with the outcome variable, (i.e., retention status after one year -- ONEYR) included high school rank (.31), high school grade point average (.27), ACT test score (.23), and adequacy of prior education (.21). All the remaining correlation coefficients were at or below .19. See Table 4 for details.

Logistic Regression Models

To verify the models on a sample of students not used to develop the model, the sample was split into two approximately equal groups--919 cases used to develop the model and 864 cases used to verify the model. Of the 919 cases selected for model development, 166 cases were included in the analysis. The remaining 753 cases were not included because of missing data on one or more independent variables. Of the 864 cases selected for model verification, 164 cases were included in the analysis.

All of the predictor variables that were not excluded because of the tests for the assumptions were available for inclusion in the models. At least one level of all available variables was utilized in the direct model. However, only two variables, ACTCOMP and DEGREELU(1), were selected by the program in the forward stepwise model.

Direct Model

Goodness-of-Fit. A test of the direct model against a constant-only model was statistically reliable, with $c2(31, N=166) = 59.9$, $p < .001$. This indicated that the predictors, as a set, reliably distinguished between returning and withdrawing students. Calculation of the goodness-of-fit statistic for the direct model yielded a value of 142.9, verifying that the differences between the observed and predicted values were large. Prediction success for the cases utilized in the development of the model was relatively high, with an overall prediction

success rate of 77.1% and correct prediction rates of 88.0% for the returning students and 56.9% for the withdrawing students.

When the model was validated with the second group of cases, overall and group prediction dropped, with an overall prediction success rate of 58.5%, and correct prediction rates of 74.8% for the returning students and only 24.5% for the withdrawing students. The large differences between the classification results of the development and verification samples reflect an instability in the model when applied to another sample, meaning that the model might be somewhat limited for other student populations.

The variables in the direct regression model that produced significant differences between the groups at the .05 level or better, included: ACTCOMP, DEGREELU, and EMPLLEV and contributed to the logistic regression equation at the .05 significance level or higher. See Table 4.

Forward Stepwise Model

SPSS version 6.1 allows for automatic selection of models through the forward stepwise selection process. The model begins with only the constant. At each step, the variable with the smallest significance level for the conditional statistic is automatically selected. The conditional statistic is based on the difference in the likelihood for the reduced and full models. The variables selected by the program in the final iteration were ACTCOMP and DEGREELU(1).

Goodness-of-Fit. The final iteration of the conditional forward selection model was statistically reliable, with the final iteration $c2(2, N = 166) = 22.8$, $p < .001$. This indicates that the two predictor variables, as a set, reliably distinguished between returning and withdrawing students. The goodness-of-fit statistic value of 163.2 indicates large differences between the predicted and observed values. The overall percentage of cases correctly classified for the group

used to generate the model was 70.5%. The percentage correctly classified for returning students was 89.8% and that for the withdrawing students was 34.5%.

For the cases used to verify the model, the overall percentage of cases correctly classified was 62.2%. The percentage of the returning students correctly classified was 81.1% and that for the withdrawing students was 22.6%. While these latter percentages are low, particularly for the withdrawing students, a comparison shows that the percentage of cases in the forward stepwise model using verification sample was actually higher than that for the full model. The forward stepwise model was also more stable than was the direct model. Thus, these facts suggest that the forward stepwise model is the more appropriate model to use for predictive purposes.

The Regression Coefficients. The variables in the final iteration of the forward stepwise model, the values of their equation coefficients, the value and significance levels of the Wald statistics, and the related R values are presented in Table 4. The equations for this logistic regression model are: u = 2.8834 - .1713*ACTCOMP + .6468*DEGREELU(1), and where e is the natural logarithm.

As the equation is logarithmic, the impact of each variable on Y (pred.) will vary by value. For ACTCOMP, a higher ACT score results in a lower probability value, meaning that the higher the score, the more the likely a student is to return. The SPSS logistic regression program automatically generates two dummy variables for each value of a categorical variable. DEGREELU(1) refers to intention to obtain an associate degree. Based upon the regression coefficient, students who did not intend to obtain an associate degree had a greater probability of returning, while responses indicating the students were seeking an associates degree had a higher probability of withdrawal. See Table 4.

Contrasting black residential students to white commuter students. When compared to black residential students, white commuter students were significantly: (a) more likely to be pursuing

an associate's degree and less likely to be pursuing a bachelor's degree at the University studied; (b) more likely to ultimately be pursuing an associate's degree or a bachelor's degree and less likely to be pursuing a master's degree; (c) less likely to be seeking a degree; (d) more likely to be employed either part- or full-time; (e) less likely to receive financial aid the first semester; (f) less likely to be receiving financial aid in the form of grants, loans, or scholarships; (g) more likely to spend ten hours per week or less on homework; (h) are more likely to require no developmental courses and less likely to require developmental courses in two or three areas; (i) more likely to be male; and (j) more likely to attend the University studied part-time. In addition, when compared to black residential students, white commuter students: (a) have higher mean ACT composite and mean ACT math scores; (b) have lower mean scores on their view of the adequacy of their high school education; (c) are older; (d) have higher mean high school grade point averages; (e) have higher high school percentile rank; (f) indicate less initial satisfaction with the University studied; (g) have a lower view of their actual selves, and (h) have higher expectations regarding their ideal selves. See tables 5 and 6.

Summary and Conclusions

This study looked at the ability of pre- and early-matriculation variables to predict the retention or attrition of black residential and white commuter students at an historically black, open admissions university. Using a categorical scheme developed by Bean & Metzner (1985) as an initial framework, we examined 25 predictor variables to see if they could predict future retention status. With retention status as the dependent variable, direct and forward stepwise models were developed. To verify the ability of the models to correctly classify students, the sample was split into two approximately equal groups and separate direct and forward stepwise logistical regression models were developed.

Compared to withdrawing students, returning students were significantly more likely to report better academic habits and goals -- i.e, pursue a bachelor's degree, study more, take fewer developmental courses, have higher ACT scores, and have higher high school grades and class rank. Returning students were more likely to receive financial aid in the form of a grant or scholarship and more likely to be a white commuter student and attend college full-time. They also reported a significantly higher mean score of adequacy of their high school education. Further, the predictor variables that had the highest correlation coefficients with one year retention status were ACT Test Score, ACT math subscore, adequacy of prior education, high school grade point average, high school rank, and student view of actual self. These results corroborate a substantial number of studies that concluded that differences exist on pre- and early-matriculation variables for returning and withdrawing students.

When the variables were either entered into a direct logistic regression model or were available for inclusion into a forward stepwise logistic regression model, they did a good job of correctly predicting the retention status of the cases used to develop the model. However, their ability to successfully predict dropped considerably when the model was applied to the to the verification samples. The overall successful prediction rate for the verification sample dropped to 58.5%, with successful prediction rates of 74.8% for the returning students and 24.5% for the withdrawing students. While the overall successful prediction rate for the forward stepwise model was somewhat lower on the development sample, the model proved to be more stable when applied to the verification sample. The overall successful prediction rate was 62.2%, with successful prediction rates of 81.1% for the returning students and 22.6% for the withdrawing students. Thus, it was determined to be the better model of the two for predicting retention status when the sample wasn't separated by residence/ethnic status.

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Two variables, ACTCOMP and DEGREELU(1) were entered by the program into the forward stepwise model. The regression coefficient for ACTCOMP suggested that those students with higher ACT scores were more likely to return for the second year. This result agrees with the findings related to academic aptitude and achievement of the American College Testing Program (1993), Civian & Schley (1996), and others.

Students intending to obtain an Associate degree were more likely to withdraw. This corroborated the findings of Lenning (1982), that indicated students aspiring to doctoral or professional degrees were more likely to persist than were those with lower degree aspirations. It also confirmed the relationships that Hackman & Dysinger (1970) found between student commitment and retention. This fact does suggest a potential for utilization of the level of commitment in any early intervention strategies.

The results suggest that pre- and early matriculation variables can be relatively successful in predicting which students will return to college, but are not as successful in identifying those students whom are likely to withdraw from college after one year. However, there were significant differences between black residential students and white commuter students on the pre- and early-matriculation variables which may influence the ability of models that combine the students to predict retention status.

When comparing the black residential students to the white commuter students a number of differences were observed that could have an effect on students retention rates. As a group, the white commuter students were more likely to enroll part-time (20% vs 1%), were less likely to get financial aid grants (30% vs 64%), studied fewer hours (78% vs 67% indicated less than 10 hours per week), were more likely to be employed (76% vs 31%), had higher high school GPA's (2.59 vs 2.32), were less likely to use a loan to pay for school (19% vs 56%), were slightly less satisfied with the university, and had higher ACT scores.

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The fact that significant differences were found on so many variables, supported the findings of other studies reporting differences in the retention status of black and white students (Feldman, 1993; Noel, Levitz & Saluri, 1985; Ramist, 1981; Terenzini, Pascarella & Lorang, 1982) as well as between residential and commuter students (Astin,1973; Beal & Noel, 1980; Herndon, 1984; Pascarella, 1982). These findings also point to the plausibility of developing individual models for black residential and white commuter students.

The fact that the pre- and early-matriculation variables used in this study consistently underestimated the likelihood that a student would withdraw indicates that other factors were involved for withdrawing students. While there could be a variety of factors, those most often cited in the literature relate to academic and social integration. In this regard, our findings do support the models of Bean (1985), Tinto (1975, 1987), Pascarella (1982) and others that emphasize the experiences of the student while enrolled in college. Eimers and Pike (1997) also found that academic integration was particularly important in contributing to the academic success of minority students.

Because academic integration and social integration are generally perceived as longitudinal outcomes, their measurement focuses on events or outcomes that take place well into the collegiate experience. Assuming the college experiences are critical in explaining retention status, this does not bode well for the efforts of historically black and open admissions institutions to correctly identify students who are likely to withdraw prior to or shortly after their enrollment. While the inclusion of other factors, such as high school grades in subject areas or the income levels or educational attainment of parents may have some impact, it is unlikely that their inclusions would have increased the prediction success rates enough to provide a model that could be relied upon to consistently predict students who withdraw prior to their second year.

Instead, it appears that other means of identifying these students must be developed by these institutions.

This study attempted to predict retention status by using pre-matriculation variables and comparisons for both residence and ethnic status, yet there are some limitations inherent in the design. First is the fact that high correlative relationships were found among several of the variables. As a means of reducing multicollinearity, one of the bivariate pair variables were removed for bivariate correlation values of greater than .75. While this was an appropriate strategy, it must be emphasized that the removal of one of these variables does not mean that the variable would not have a causal relationship to retention or attrition.

Secondly, while most of the key retention/attrition factors identified in the literature are included in the study, there are a number of factors related to student retention or attrition that were not available. In particular, income and educational level of the parents of the student and other socioeconomic variables have been related to retention or attrition by a number of researchers (Astin, 1975; Beal & Noel, 1980; Stoecker, Pascarella, & Wolfe, 1988). Religious status and beliefs have also been linked to attrition or retention (Astin, 1975; Beal & Noel, 1980; Cope & Hannah, 1975), as has the level of student-faculty interaction (Allen, 1986; Fox, 1986; Pascarella, Smart, & Ethington, 1986). In addition, the high school grades earned in course areas (e.g., English, mathematics, science) have been useful in predicting college retention (Civian & Schley, 1996). Due to the research's focus on pre- and early-matriculation criteria and the limited access to some types of data, all of these aspects might have limited the predictive validity of the models.

This study was one of the few attempts to look exclusively at pre- and early-matriculation variables to predict to one-year student retention status. Consequently, it was an attempt to help college officials in selecting student who will be most successful at their institutions. Given the

limited success of the models in this study to predict withdrawing students, there are a number of recommendations that can be made to develop models that have more predictive value. First, researchers could use socioeconomic factors of the parents as well as actual high school grades of the students. Both factors have been shown to relate to student retention status. While they were not available in the university records for the sample of students used in this study, most institutions collect such information as part of their admissions information. Second, researchers could develop models based on a multi-university sample of historically black and open admissions institutions. This approach might help determine if the findings of this study were limited to the unique characteristics of the university examined or if the results could generalize to other similar institutions. This could include samples that differentiate between institutions with predominantly black enrollment and those that are more than 50 percent white. Third, researchers could utilize a sample of students that include black commuter and white residential students. This strategy would permit the analysis and evaluation of the impact of resident status and ethnicity as distinct factors. While of these types of students were not available from the university used in this study, such students might be available at other historically black institutions with open admissions institutions policies.

In addition, researchers could design models that utilize academic outcome and social integration variables to predict retention status. This was not the intent of the existing models because the purpose was to explore early prediction of student withdrawal. However, an examination of the relationships of these variables with pre- and early-matriculation variable might help shed light on the reasons that the models based on pre- and early-matriculation variables consistently incorrectly classified many of the withdrawing students.

Finally, it is recommended that those colleges and universities that are developing early intervention strategies pay specific attention to the significant differences found in this study

between both black and white students and residential and commuter students. In particular, the fact that the level of commitment was found to be a significant variable in the logistic regression models suggests that this factor should be considered for incorporation into such early intervention strategies.

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Table 1

Variables Available for Use in the Analyses Related to the Research Questions

Variable used in models
ACT composite test scores (ACTCOMP)
ACT math test scores (ACTMATH)
Adequacy of prior education (ADEQPRIR)
Age of student (AGE)
Level of degree sought at the University studied (DEGREELU)
Level of ultimate degree sought (DEGREEUL)
Intention to seek a degree (DEGYES)
Number of hours worked per week (EMPLLEV)
Whether or not student financial aid was received in the first semester (FA_FST)
Importance of obtaining a degree (GOAL3)
Whether or not the student financial aid received was in the form of a student grant (GRANT)
Number of hours spent per week doing homework (HOMWK)
High school grade point average (HS_GPA2)
Whether or not the student financial aid received was in the form of a student loan (LOAN)
Number of developmental courses that the student is required to take (NUMDS)
Percentile high school rank (RANK2)
Level of initial satisfaction with the University studied (SATISLU2)
Whether or not the student financial aid received was in the form of a scholarship (SCH)
Student's view of actual self (SELFVIEW)
Student's view of ideal self (SLFIDEAL)
Enrollment status (STATUSEN)

Variables Eliminated from Consideration for the Analyses Related to the Research Questions
ACT English test subscore (ACTENG)
ACT reading test subscore (ACTREAD)
ACT Science Test Subscore (ACTSCI)
Whether or not a student is employed on campus (EMPLCAMP)
Whether or not a student is married (MARRIED)

Table 2

Summary of variable comparisons for returning/nonreturning students: Percentages and Chi-Square Significance Levels for the Categorical Variables.

Variable	Return %	Withdraw %	χ^2	df
Degree Plans				
Associates Degree.	18.5	29.2		
Bachelors. Degree.	81.5	70.8	16.77**	1
Degree Goal				
Associates Degree.	3.6	5.1		
Bachelors. Degree.	25.0	23.9		
Masters Degree.	71.4	71.0	1.91	2
Intentions to Seek Degree				
Yes	79.0	78.4		
No	21.0	21.6	0.10	1
Employment Level				
Not Employed	41.2	40.4		
Employed less than1/2 time	36.0	35.3		
Employed more than 1/2 time	22.8	24.3	0.52	2
Received Financial Aid				
Yes	67.0	65.7		
No	33.0	34.3	0.34	1
Importance of Degree				
No Importance	1.3	2.2		
Little Importance	1.6	2.9		
Some Importance	6.9	7.8		
Great Importance	90.2	87.0	5.04	3
Financial Aid was Grant				
Yes	40.1	59.9		
No	46.9	53.1	8.18**	1
Weekly Time on Homework				
0-5 Hours	37.2	44.0		
6-10 Hours	35.0	31.8		
11-15 Hours	17.3	13.5		
16-20 Hours	7.6	6.8		
21-25 Hours	1.8	2.4		
26+ Hrs.	11.1	1.5	11.35*	5
Financial Aid was Loan				
Yes	27.9	40.0		
No	72.1	60.0	28.83**	1
Number of Developmental Courses				
None	32.8	20.9		
One Area	26.8	23.1		
Two Areas	23.1	24.6		
Three Areas	17.4	31.3	61.97**	3
Financial Aid - Scholarships				
Yes	28.4	17.0		
No	71.6	83.0	31.70**	1
Gender				
Male	42.9	45.4		
Female	57.1	54.6	1.12	1
Enrollment Status				
Part-time	10.3	16.0		
Full-time	89.7	84.0	12.89**	1

* $p < .05$ ** $p < .01$

Table 3
Summary of variable comparisons for returning/nonreturning students:
Means and t-statistics for the Interval Variables

Variable	Returned $\bar{X}$	Withdrew $\bar{X}$	Difference	t-value.
ACTCOMP	18.53	7.16	1.37	7.65*
ACTMATH	17.29	16.12	1.16	6.21*
ADEQPRIR	74.23	74.49	1.73	2.88*
AGE	20.03	19.85	0.18	0.74
HS_GPA2	2.54	2.35	0.19	4.72*
INTSTAT1	37.25	35.76	1.48	3.74*
RANK2	0.53	0.42	0.10	7.76*
SATISLU2	18.22	17.70	0.52	1.49
SELFVIEW	42.37	42.41	-0.05	-0.16
SLFIDEAL	47.83	47.24	0.58	1.93

*significant at .05 level

Highest Correlations of the Criterion Variable with the Predictor Variables, All Students

Description	Variable	Corr. Value
High School Rank	RANK2	.31
High School Grade Point Average	HSGPA2	.27
ACT Test Score	ACTCOMP	.23
Adequacy of Prior Education	ADEQPRIR	.21

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Table 4

Title: Coefficient Values, Wald Statistics, and R-Values of the Significant Variables in the Logistic Regression Model for All Students

Variable	Coeff.	Wald Stat.	Sig.	R-Value
ACTCOMP	- .2600	4.3502	<.05	-.10
DEGREELU(1)	.9214	10.0794	<.05	.19
EMPLLEV(1)	.6520	3.8422	<.05	.11
Forward Stepwise Logistic Model				
ACTCOMP	- .1714	11.0448	<.05	- .2052
DEGREELU(1)	.6468	9.6133	<.05	.1883
Constant	2.8834	8.9302	<.05	

Table 5

Summary of Percentages and Chi-Square Significance Levels for the Categorical Variables, Black vs. White Students

Variable	Black Residential %	White Commuter. %	χ^2	df
Degree Plans				
Associates. Degree	19.5	25.1		
Bachelors Degree	80.5	74.9	4.52*	1
Degree Goal				
Associates. Degree	1.3	6.3		
Bachelors Degree	16.8	29.9		
Masters Degree	81.9	63.8	56.62**	2
Intentions to Seek Degree				
Yes	88.9	72.3		
No	11.1	27.7	68.67**	1
Employment Level				
Not Employed	68.6	23.4		
Employed less than 1/2 time	27.3	41.0		
Employed more than 1/2 time	4.1	35.6	406.19**	2
Received Financial Aid				
Yes	86.3	53.7		
No	13.7	46.3	199.70**	1
Importance of Degree				
No Importance	2.1	1.5		
Little Importance	2.5	2.0		
Some Importance	5.4	8.5		
Great Importance	90.1	88.0	4.97	3
Financial Aid was Grant				
Yes	64.0	29.9		
No	36.0	70.1	199.63**	1
Weekly Homework				
0-5 Hours	36.6	42.7		
6-10 Hours	30.9	35.3		
11-15 Hours	17.6	14.3		
16-20 Hours	9.6	5.7		
21-25 Hours	3.3	1.3		
26+ Hours	2.0	0.7	30.96**	5
Financial Aid was Loan				
Yes	56.0	18.8		
No	44.0	81.2	263.03**	1
Developmental Courses				
None	14.9	35.4		
One Area	18.6	29.2		
Two Areas	29.5	20.2		
Three Areas	37.0	15.2	184.09**	3
Financial Aid Scholarships				
Yes	30.8	18.5		
No	69.2	81.5	35.82**	1
Gender				
Male	40.0	46.6		
Female	60.0	53.4	7.34*	1
Enrollment Status				
Part-time	1.0	20.4		
Full-time	99.0	79.6	142.25**	1

Table 6

Means and t-statistics for the Interval Variables, Black vs. White Students

Variable	Black Residential	White Commuter	Difference	t-Val.
ACTCOMP	16.05	19.13	-3.08	-18.17*
ACTMATH	15.62	17.53	-1.91	-10.27*
ADEQPRIR	74.25	72.97	-2.62	-11.07*
AGE	18.34	20.96	1.27	2.06*
HS_GPA2	2.32	2.59	-0.28	-7.08*
INTSTAT1	36.49	36.64	-0.15	-0.36*
RANK2	0.45	0.50	-0.56	-3.96 *
SATISLU2	19.45	17.09	2.36	6.69*
SELFVIEW	43.69	41.62	2.07	7.04*
SLFIDEAL	46.53	48.19	-1.66	-5.38 *

*significant at .05 level